STUDY ON BIODIVERSITY OF FLOODPLAIN WETLANDS OF RIVER YAMUNA IN DELHI STRETCH

ABSTRACT
OF
THESIS SUBMITTED TO JAMIA MILLIA ISLAMIA
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
2006

TANVEERA TABASUM

DEPARTMENT OF BIOSCIENCES
JAMIA MILLIA ISLAMIA
NEW DELHI-110025
INDIA

&

WETLANDS INTERNATIONAL-SOUTH ASIA
NEW DELHI-110024
INDIA

STUDY ON BIODIVERSITY OF FLOODPLAIN WETLANDS OF RIVER YAMUNA IN DELHI STRETCH

Tanveera Tabasum

Department of biosciences, Jamia Millia Islamia

Abstract

The river Yamuna in Delhi is a highly braided system due to construction of embankments all along the stretch for flood protection. The floodplain area restricted within two bunds cover an area of 94.84 sq. km. the longitudinal and lateral flows of water within the stretch essentially determine the floodplain of the river system. The rainfall, confined to the monsoon from July to October, results in the lateral flow of water after attaining bank-full level of the river channel. The river is left with limited flood plain area for inundation even during monsoon. The maximum width of active floodplain is observed near Okhla where a large quantum of water is brought through Hindon cut. The channel morphology in this area also helps to maintaining a large floodplain area subjected to inundation almost throughout the year.

Four zones were identified in the river stretch based on hydrological features water quality characteristics and biodiversity. These zones included: zone I from Jhangola to upstream Wazirabad barrage; zone II from downstream Wazirabad barrage to upstream ITO; zone III from ITO downstream to upstream Okhla and zone IV from Okhla downstream to Jaitpur. Zone I was observed to be relatively cleaner compared to zones II and IV, which were highly polluted due to discharge of sewage and industrial pollutants brought in by various drains. Zone III may be designated as the restoration zone where water quality was slightly improved due to large floodplain area created by inflow of water from Hindon cut. Hydrological regimes essentially govern water quality characteristics as was reflected by high concordance between the two data sets.

Water quality strongly influenced distribution and extent of biodiversity. Planktonic and benthic organisms were critically linked to changes in ambient environment and species present were either tolerant to the rigorous chemical milieu or had wide ecological amplitude.

A narrow zone of floodplain was the limiting factor for the growth and proliferation of vegetation all along the stretch except at Okhla where inundation of large area floodplain supported large stands of *Typha angustata* and other associated species.

Overall, 74 species of macrophytes, 90 species of phytoplankton, 62 species of zooplankton and 55 species of benthos were identified from the study sites. Distribution of phytoplankton along the longitudinal gradient indicated clear demarcation of species composition among the sites subjected to varying degree of pollution. Desmids, zygnematales, cladophorales, ulotrichales and diatoms were predominant in zones I and

III. Chlorococales and euglenophycaea mainly distributed in zone II and IV were indicative of their tolerance levels to pollution. In general, predominance of Cyanophyceae, Euglenophyceae and Chlorococales throughout the stretch reflected deteriorated water quality conditions.

Zooplankton was represented by Cladocera, Rotifera and Copepoda throughout the study sites. Cladocerans and Copepoda were predominant in the upper zone and restoration zone while as Rotifera thrived well under polluted conditions in the mid zone. Higher species richness of Cladocerans was observed during post-monsoon in zones II and IV subjected to high load of pollution. Copepods were, however, dominant in zone III during monsoon.

Macro-benthic fauna observed in the study area was represented by Mollusca, Insecta and Annelida. Mollusca had the highest species richness in zone I and the lowest in zone II. The species number, however, increased at Okhla. The progressive elimination of molluscan species and domination of Insecta/ Annelida was observed in downstream of Wazirabad. Okhla also had he highest benthic population density peak contributed by chironomids during pre- and post-monsoon and molluscans during monsoon. Mid-stretch, subjected to serve pollution, had the lowest population density mainly contributed by tubificids.

The analyses of continuity/ discontinuity of biodiversity along longitudinal gradient indicated significant heterogeneity within the river stretch. Higher gain of species in zone I is attributed to occurrence of maximum number of water bodies in thin zone. Inundation of floodplain area at Okhla is also a contributory factor for enhanced biodiversity at this site.

Co-inertia analyses demonstrated a grading of concordance between species datasets and water quality datasets. Benthic fauna exhibited the highest degree of correlation with water quality compared to planktonic communities thereby indicating that benthic species mirror water quality changes. The influence of water discharge was more pronounced in case of planktonic species.

Assessment of concordance between water quality parameters and species density indicated significant co-structure for zone II and IV. This highlights that pollutants due to their toxic effects are causative factors for biodiversity reduction.

Assemblage of 29 species exhibited strong relationships with water quality parameters. These include 19 benthic, 4 zooplanktonic and 6 phytoplanktonic species, which could be effectively used for bio-monitoring along with the physicochemical parameters of water.

The study carried out highlighted importance of floodplain wetlands in maintaining/ enhancing biodiversity and use of sensitive species, particularly of benthos for monitoring health of the ecosystem. The strategy to be adopted should aim at restoration of biodiversity to at least minimum level as currently existing in the upper stretch through optimizing water regimes and control of pollution. While optimizing species richness and

diversity, inundation of floodplain is critical to the control of pollution through ecological processes.

The services and functions provide naturally by these wetlands as elaborately dealt in the thesis, clearly highlights the role of floodplain areas in water resources management and maintenance of biodiversity. While a broad strategy needs to be adopted for land and water use planning of the floodplain area, it is recommended that steps need to be initiated to recognize values and functions of the floodplain area and their integration into overall river management. The Yamuna action plan needs to suitably incorporate floodplain conservation as an integrated component of the action plan and thus integration ecological aspects into management planning. The following specific recommendations are made for integrating conservation and wise use of river Yamuna floodplains into river basin management:

- Recognition of floodplain as ecologically fragile area in land use planning
- Regeneration of floodplain area for flood control and biodiversity conservation
- Allocation of water for human and ecological purpose considering requirement of water by floodplains for maintenance of their processes and functions
- Application of artificial wetland techniques for improvement of water quality through treatment of pollution from diffused sources
- Ensuring connectivity of lakes/ ponds within floodplains with river channel for conservation of biodiversity
- Application of biological indices to assess overall health of river ecosystem. A list of indicator species proposed need to be monitored along with the water quality parameter to assess efficacy of restorations measures
- Ecotourism development at Okhla bird sanctuary
- Participatory planning involving local communities in conservation and management of floodplain system and development of alternate livelihoods to reduce pressure on wetlands.